Remarks

In the Office Action dated November 20, 2002, the Examiner rejected claims 12 and 24 under 35 U.S.C. § 112, first paragraph. The Examiner rejected claims 1, 9-11, 13, 15-16, 18-23, 25-38 and 40-41 under 35 U.S.C. § 103 as being unpatentable over the U.S. Patent to Azima, et al., 6,377,695 in view of the U.S. Patent to Clark 5,754,664. The Examiner rejected claims 2-4, 14 & 17 under 35 U.S.C. § 103 as being unpatentable over Azima as modified by the U.S. Patent to Clark and further in view of the U.S. Patent to House 5,887,071. The Examiner rejected claims 5-8 under 35 U.S.C. § 103 as being unpatentable over Azima as modified by Clark and further in view of the U.S. Patent to Marquiss 4,385,210. The Examiner rejected claim 39 under 35 U.S.C. § 103 as being unpatentable over Azima as modified by Clark and further in view of the U.S. Patent to Watanabe 5,450,057.

By this Amendment, Applicants' Attorney has amended the specification to incorporate the substance of claim 24 regarding stiffness. Consequently, no new matter has been entered. With respect to claim 38, the phrase beginning with "ect" has been eliminated.

By this Amendment, Applicants' Attorney has amended the only independent claim in this application to more particularly point out and distinctly claim what Applicants regard as their invention. In particular, independent claim 1 now states that "substantially the entire headliner acts as a single headliner speaker diaphragm and radiates acoustic power into the interior of the vehicle with a frequency range defined by a lower limit of 100 Hz or less and an upper limit of 12 kilohertz or more". Clearly, this feature is neither taught, disclosed nor discussed by any of the references of record including the references cited by the Examiner. In particular, the U.S. Patent to Azima, et al. discloses a trim panel in the form of a roof lining which includes a plurality of integral acoustic radiators and a plurality of vibration excitors mounted on the radiators to launch bending waves into the radiators to cause them to resonate to produce an acoustic output. Clearly, Azima, et al. fails to disclose a headliner as presently claimed in the present application wherein substantially the entire headliner acts as a single headliner speaker diaphragm and radiates acoustic power into the

interior of the vehicle with a frequency range defined by a lower limit of 100 Hz or less and an upper limit of 12 kilohertz or more.

New claims 43 and 44, correspond to old claims 12 and 24, respectively, which the Examiner failed to reject based on the prior art.

Consequently, in view of the above and in the absence of better art, Applicants' Attorney respectfully submits the application is in condition for allowance which allowance is respectfully requested.

Respectfully submitted,

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By _____

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Attachment

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In The Specification

The headliner material has a stiffness (modulus of elasticity, Youngs modulus) between 1E9 Pa and 5e9 Pa and a density between 100 and 800 Kg/m^3. For one implementation of the preferred embodiment, the headliner 11 or speaker diaphragm was constructed of TRU (thermal foamable rigid urethane) with material properties of 7 mm thickness, Young's modulus of elasticity = 2e9, density of 231 kg/m^3, damping of 4.5%. The headliner 11 was covered with a foam coverstock 28 for cosmetic and damping purposes. Although well established sound reinforcement guidelines of signal delay vs. signal level difference exist for success of precedence with discrete drivers, these must be modified to account for any significant headliner diaphragm vibrations traveling faster than the speed of sound in air. This is typically accomplished through trial and error techniques with listening evaluations.

In The Claims

1. An audio system for use in a vehicle having a roof, the system comprising:

an acoustically-insulating headliner adapted to be mounted adjacent the roof so as to underlie the roof and shield the roof from view, the headliner having an upper surface and a sound-radiating, lower surface;

a source of audio signals;

an array of electromagnetic transducer assemblies supported at the upper surface of the headliner;

signal processing circuitry coupled to the assemblies for processing the audio signals to obtain processed audio signals wherein the assemblies convert the processed audio signals into mechanical motion of corresponding zones of the headliner and wherein the headliner is made of a material which is sufficiently stiff and low in density so that substantially the entire headliner acts as a single headliner speaker diaphragm and radiates acoustic power into the interior of the vehicle with a frequency range defined by a lower limit of 100 hertz or less and an upper limit of 12 kilohertz or more and the processed audio signals at a low end of the frequency range are matched to the processed audio signals at mid and high ends of the frequency range.

38. The system as claimed in claim 1 further comprising at least one microphone positioned in the interior of the vehicle for intra-cabin and extra-cabin communications [(cellular, digital, etc)].

< 100 Hz
> 12 KHz
100 - 12 KHz.